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ABSTRACT

The paper presents a discussion of human mental processes as they relate to learning disabilities. Pathognomonic symptoms associated with disturbances to brain areas or functional systems are discussed, as well as treatment procedures. This brain behavior relationship is offered as a basis for a classification system that is seen to more clearly define attention and learning disabilities and to afford more precise and reliable strategies for diagnosis and treatment. Ninety-two symptoms are grouped in a screening checklist format for the areas of attention, perception, mood, memory, and movement. A multidisciplinary treatment approach involving medicine, neuropsychology, and education is recommended. (Author/DB)

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SYSTEMIC ANALYSIS OF BRAIN MECHANISMS UNDERLYING LEARNING DISABILITIES:

An Introduction to the Brain Behavior Relationship

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SYSTEMIC ANALYSIS OF BRAIN MECHANISMS UNDERLYING LEARNING DISABILITIES:

An Introduction to the Brain Behavior Relationship

ABSTRACT:

Systemic analysis of brain function describes learning as a very active process relying on a working relationship of a variety of brain zones. Human mental processes, or behaviors of learning, incorporating attention, perception, memory, mood and movement are viewed as integrated functions which interrelate throughout development. Pathognomonic symptoms associated with disturbances to brain areas associated with disturbances of these functional systems are discussed, as well as treatment procedures. Also presented is how this brain behavior relationship affords a classification system that more clearly defines attention and learning disabilities and affords more precise and reliable strategies for diagnosis and treatment. This multidisciplinary model founded upon the interface of medicine, neuropsychology and education promotes the psychological well being and educational success of preschool and school age children. The societal impact of the success of this model is paramount.

It is fundamental that the brain is the organ of mental activity. In the Middle Ages, mental activity was viewed as developed in three ventricles. In the mid-19th Century, Paul Broca and Carl Wernicke contributed to the description of speech as a functional process involving several brain zones. At the end of the 19th Century, Hughlings Jackson tried to establish that complex mental acts were associated with "levels" of structure versus localized areas. It took approximately fifty years for his ideas to surface again. Many deserve to be heralded for their attempts to expand upon Jackson's framework. Alexander Luria is particularly heralded for his theories describing human mental processes as complex functional systems based upon the working relationship of a variety of brain zones which are, in part, dependent upon external cues for development and are never static. Learning is, no doubt, a very active process and, hence, it makes sense to embrace the view that learning involves the working relationship of a variety of brain zones associated with the functions of attention, perception, movement, memory and mood. It also follows that these complex functions are dependent upon genetic predisposition, as well as external cues and that, together, a multigenerational transmission process develops.

Sociologically, higher incidence rates of drug and alcohol abuse and head injury contribute to this generational transmission process. It is not surprising that we find ourselves at a time of significantly low national test scores and heightened deficits in attention, learning and mood within our school systems. The crack/cocaine babies are just now entering school years and the results of these deficits will certainly heighten. The functional effects of insults to the brain upon behavior is pervasive within our schools.

It is from this perspective that the writer embraces a marriage between medicine, neuropsychological and educational models in order to promote the psychological well being and educational success of our preschool and school age children. Needed is the increased awareness that most learning problems are related to subtle neurological disturbance, electrical or chemical, with a smaller percentage of structural anomalies. These disturbances impact the learning processes of attention, perception, mood, memory and movement. Most people have little difficulty understanding that a stroke (cerebral vascular anomaly) produces problems in learning. Most understand that it can affect the sensory motor strip of the brain associated with paralysis or paresis. Even variance in attention and mood are understood, yet not as well, because these symptoms are "not as visible to the eye." Individuals with attention and learning disabilities who have not suffered acute brain trauma experience subtle neurological changes producing behavioral changes of attention, perception, memory, mood and movement. Some individuals have more impact to brain areas producing perceptual/dyslexic symptoms. Others have more attention deficits, with or without hyperactivity. Others have speech and motor variance, etc.,

while others experience mood disturbances. Just as with any functional system, it is possible for an individual to experience variances in all symptoms and other individuals to experience more selective impact upon certain brain areas.

Lurian theory underscores this framework and suggests that human mental processes involving learning is founded upon three central principles.

(1) Learning is regulated by a waking state and follows Pavlov's law of strength that every strong stimulus produces a strong response and a weak stimulus produces a weak response. Variance in selective attention, with or without hyperactivity, and variance in primary memory traces, are the results of cerebral disturbance incorporating parts of the diencephalic limbic system and medial areas of the cortex.

(2) Learning involves the reception, analysis and storage of information. Cerebral disturbance to the lateral regions of the posterior cortex result in perceptual, mnestic and sensory deficits incorporating all sensory modalities. Dyslexic syndromes involve particular disturbances to these areas incorporating a systemic effect with the areas described above.

(3) Learning involves voluntary attention and expressive methods involving planning, regulation and verification of stimuli (verbal, nonverbal and motor). Disturbances to the anterior brain areas result in variance of these functions. Some pathognomonic symptoms associated with cerebral disturbance impacting learning processes of attention, perception, memory, mood and movement are as follows:

ATTENTION:

Varied attention, with hyperactivity _____
Varied attention, without hyperactivity _____
Looks underaroused/"hypoactive" _____
May act before thinking _____
Difficulty organizing work _____
Distractibility _____
Poor concentration/daydreams _____
Difficulty falling asleep _____
Sleepwalking _____
Sleeptalking _____
Excessive nightmares _____
Night terror (yells out at night with little response to calming down; may not have memory for the episode) _____
Enuresis (bedwetting, day or night) _____
Encopresis (soiling, day or night) _____
Constipation _____
History of head banging _____

Restlessness _____
Rocking _____
Easily forgets assignments _____
Incomplete assignments _____
Difficulty following directions _____
Much repetition needed _____
Heightened sensitivity to sound _____
Heightened sensitivity to touch _____

PERCEPTION: Variance in the reception, analysis and synthesis of auditory and visual stimuli, as well as combined stimuli. Symptoms may be associated with the basis of visual and auditory dyslexic syndromes.

Extra eye movements _____
Decreased visual tracking _____
Visual convergence/divergence variance (decreased ability of the eyes to turn inward for near distances, or outward for far distances) _____
Visual focusing deficits _____
Letter/number reversals _____
Slow pace when reading _____
Fast pace when reading _____
Uses finger for guidance when reading _____
Holds head close to paper _____
Skips words or phrases when reading _____
Paraphasias (sounds like, or has similar meaning to another word) _____
Difficulty with oral expression _____
Difficulty with written expression _____
Spelling dyspraxia (difficulty with spelling) _____
Dyscalculia (difficulty with math) _____
Difficulty understanding concepts _____
Fast pace when speaking _____
Slow pace when speaking _____
Decreased word recognition _____
Confuses similar letters _____
Confuses similar sounds _____
Right - left confusion _____
Poor copying skills _____
Difficulty telling time on a clock _____
Word finding problems _____
Figure ground deficits _____
Confuses the spatial positions of numbers and letters _____
Decreased sequencing, auditorally or visually _____
Difficulty understanding body parts _____

MOOD:

Decreased self-esteem _____
Emotional volatility _____
Easily frustrated (can occur with heightened positive or negative stimuli) _____

Heightened sensitivity _____
Crying or temper outbursts _____
Impulsivity _____
Discipline problems due to poor attention span _____
Discipline problems due to overt acting out (fighting ...) _____
Frequent mood changes _____

MEMORY: May be the basis of memory related dyslexic syndromes.

Decreased retrieval from immediate auditory memory _____
Decreased retrieval from immediate visual memory _____
Long term memory variance _____
Decreased verbal spontaneity _____
Decreased spontaneity when writing _____
Varied reaction times _____
Decreased comprehension (oral/written work) _____
Difficulty following directions _____
Incomplete assignments _____
Seems to need much repetition of information _____
Seems to need longer time intervals for answers _____
Global difficulty memorizing information _____
Decrease in word finding skills _____

MOVEMENT:

Incoordination (clumsy or awkward movements) _____
Tic-like behavior (shoulder shrugging, lip licking, lip smacking, eye twitching, etc.) _____
Awkward position _____
Nervous habits _____
Poor pencil grasp _____
Tight pencil grip _____
Excessive motor movement _____
Poor articulation of speech _____
Poor melody of speech _____
Poor handwriting _____
Difficulty with tactile form recognition _____
Poor balance _____
Poor skipping ability _____
Perseverative movement _____

This systemic view of symptoms can act as a screening process in assessing attention and learning disabilities, and aid in recognizing whether neuropsychological or other formal tests are necessary. This systemic analysis of brain function also affords a classification system which more clearly defines attention and learning problems and affords a more clear and precise method for diagnosis and treatment. The confusion/debate regarding Attention Deficit Disorder and learning

disabilities does not exist when this model is well understood. In addition, it aids in differentiating organic versus situational/emotional problems, insures against misclassification, and aids in targeting those individuals whose talented intellectual functioning may allow for compensation on standardized achievement tests, but who are failing in the classroom. These individuals, unfortunately, are often denied services. This systemic approach is also especially useful in identifying and treating early childhood deficits and prevents undue escalation of learning disabilities, the negative impact on self esteem/societal problems, and the waste of increased finances.

This interface between medicine, neuropsychology and education provides a basis for symptoms. Symptoms are not viewed as single disorders. We can move beyond assessment to holistic treatment. The results of this type of systemic neuropsychological assessment can aid in defining the degree of cerebral disturbance, the functional effect of disturbance upon all types of learning, and, therefore, aid in developing a sophisticated Individual Educational Plan (IEP) tapping both compensatory techniques, as well as perceptual training of disturbed areas. A multidisciplinary treatment approach is necessary involving the interface of medicine, neuropsychology and education, and allied professions. Treatment plans based upon this type of holistic view and brain behavior foundation promotes heightened specificity. It aids in developing the potential of individuals so that abilities versus disabilities become paramount.

Note: The presentation at the International Learning Disabilities Conference included visual presentation of case studies.